



U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of Airport Safety and Standards
Engineering and Specifications Division

800 Independence Ave., SW
Washington, DC 20591

The attached is draft Change 11 to Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5370-10A Standards for Specifying Construction of Airports. This Change revises several specifications as follows:

1. ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT, has been revised to incorporate changes in material specifications, new materials, and construction practices for slurry seals based on International Slurry Surfacing Association (ISSA) recommendations,
2. ITEM D-702 SLOTTED DRAINS has been added to provide standards for construction of slotted drains,
3. ITEM D-701 PIPE FOR STORM DRAINS AND CULVERTS and ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS have been revised to add new materials, and
4. ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES has been revised to remove the requirement for bituminous coatings on castings.

Comments are accepted through recognized industry organizations. The comment period closes August 4, 1997.



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Advisory Circular

DRAFT—Not Approved for Use

Subject: Change XX to STANDARDS FOR SPECIFYING
CONSTRUCTION OF AIRPORTS

Date:

Initiated by: AAS-200

AC No: 150/5370-10A

Change: DRAFT

1. PURPOSE. ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT, has been revised to incorporate changes in material specifications, new materials, and construction practices for slurry seals based on International Slurry Surfacing Association (ISSA) recommendations. ITEM D-702 SLOTTED DRAINS has been added to provide standards for construction of slotted drains. ITEM D-701 PIPE FOR STORM DRAINS AND CULVERTS and ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS have been revised to add new materials. ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES has been revised to remove the requirement for bituminous coatings on castings.

2. PRINCIPAL CHANGES. The following principal changes have been made:

- a. Paragraph 626-2.1 AGGREGATE has been changed to specify only two gradations, Type I and Type II.
- b. Paragraph 626-2.1a Aggregate Tolerance has been added to specify tolerances for gradation.
- c. Paragraph 626-2.3 EMULSIFIED ASPHALT has been changed to specify SS, CSS, CQS, or QS type emulsions.
- d. Paragraph 626-2.5 TACK COAT has been deleted. The information regarding tack coat has been included in CONSTRUCTION METHODS.
- e. Paragraph 626-3.1-3.4 COMPOSITION AND APPLICATION has been added as a section. This section specifies mix design and test section requirements.
- f. Paragraph 626-4.1 WEATHER LIMITATIONS has been revised to place 50 degrees F and falling (air or pavement) or 45 degrees F and rising (air and pavement) as the allowable temperature minimums.
- g. Options for crack sealing, paint and rubber removal, and surface repair have been added to Paragraph 626-4.4 PREPARATION OF EXISTING SURFACE.
- h. Pay items for crack sealing paint and rubber removal, and surface repair have been added.
- i. ITEM D-702 SLOTTED DRAINS has been added to specify construction of slotted drains
- j. AASHTO M 304 and ASTM F 949 have been added to Paragraph 701-2.2 PIPE.
- k. AASHTO M 304 has been added to Paragraph 705-2.1 GENERAL.
- l. The requirement for two coats of bituminous paint has been removed from Paragraph 751-2.6 FRAMES, COVERS, AND GRATES.

ITEM P-626 EMULSIFIED ASPHALT SLURRY SEAL SURFACE TREATMENT

DESCRIPTION

626-1.1 This item shall consist of a mixture of emulsified asphalt, mineral aggregate, and water properly proportioned, mixed, and spread on an asphalt prepared underlying course or existing wearing course in accordance with these specifications and shall conform to the dimensions shown on the plans or as directed by the Engineer.

MATERIALS

626-2.1 AGGREGATE. The aggregate shall consist of sound and durable manufactured sand, slag, crusher fines, crushed stone, or a combination thereof. The aggregate shall be clean and free from vegetable matter, dirt, and other deleterious substances. The aggregate shall have a sand equivalent of not less than [45] percent when tested in accordance with ASTM D 2419. The aggregate shall show a loss of not more than [35] percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed [10] percent, or the magnesium soundness loss shall not exceed [13] percent after 5 cycles when tested in accordance with ASTM C 88. Aggregate shall be 100 percent crushed.

The percent loss when tested under ASTM C 131 should not exceed 35. The sodium sulfate loss should not exceed 10 percent; the magnesium sulfate loss should not exceed 13 percent. In certain specific cases, where aggregates complying with those maximums cannot be economically obtained, aggregates with a higher percentage loss or wear may be specified, provided a satisfactory service record under similar conditions of service and exposure has been demonstrated.

The combined aggregate shall conform to the gradation shown in Table 1 when tested in accordance with ASTM C 136.

TABLE 1. GRADATION OF AGGREGATES

Sieve Size	Percent by Weight Passing Sieves	
	Type I	Type II
3/8 in. (9.5 mm)	100	100
No. 4 (4.75 mm)	100	90-100
No. 8 (2.36 mm)	90-100	65-90
No. 16 (1.18 mm)	65-90	45-70
No. 30 (600 micro m)	40-60	30-50
No. 50 (300 micro m)	25-42	18-30
No. 100 (150 micro m)	15-30	10-21
No. 200 (75 micro m)	10-20	5-15
Residual asphalt content percent dry aggregate	10% - 16%	7.5% - 13.5%
Pounds of aggregate per square yard	8 - 12	12 - 20
Kilograms of aggregate per square meter	3 - 4.6	4.6 - 7.6

The job mix formula (mix design) shall be run using aggregate within the gradation band for the desired type shown in Table 1. Once the mix design has been submitted and approved, the aggregate used on the project shall

not vary by more than the tolerances shown in Table 2. At no time shall the aggregate used go out of the gradation bands in Table 1.

The aggregate will be accepted at the job location or stockpile. The stockpile shall be accepted based on five gradation tests according to ASTM D 75. If the average of the five tests is within the gradation tolerances, then the materials will be accepted. If the tests show the material to be out of tolerance, the contractor will be given the choice either to remove the material or blend other aggregates with the stockpile material to bring it into specification. Materials used in blending must meet the quality tests before blending and must be blended in a manner to produce a consistent gradation. This blending may require a new mix design.

Screening shall be required at the project stockpile site if there are any problems created by having oversize materials in the mix.

Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

The aggregate gradation band applicable to a project shall be specified by the Engineer from the gradations shown in Table 1. The appropriate gradation shall be shown on the plans. Type I gradation is used for maximum crack penetration and is usually used in low density traffic areas where the primary objective is sealing. Type II gradation is used to seal and improve skid resistance.

a. Aggregate Tolerance. Once the mix design has been accepted, the aggregate gradation used on the project may vary from the aggregate gradation used in the mix design on each sieve by the percentages shown in Table 2. If the project aggregate fails to remain within this tolerance a new mix design will be required by the Engineer at the expense of the Contractor.

TABLE 2 AGGREGATE / ASPHALT TOLERANCE

	Type I	Type II	Tolerance
3/8 in. (9.5 mm)	100	100	+ or - 5%
No. 4 (4.75 mm)	100	90-100	+ or - 5%
No. 8 (2.36 mm)	90-100	65-90	+ or - 5%
No. 16 (1.18 mm)	65-90	45-70	+ or - 5%
No. 30 (600 micro m)	40-60	30-50	+ or - 5%
No. 50 (300 micro m)	25-42	18-30	+ or - 4%
No. 100 (150 micro m)	15-30	10-21	+ or - 3%
No. 200 (75 micro m)	10-20	5-15	+ or - 2%
Residual Asphalt			+ or - 1%

626-2.2 MINERAL FILLER. If mineral filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242 and shall be used in the amounts required by the mix design. The mineral filler shall be considered as part of the aggregate.

626-2.3 EMULSIFIED ASPHALT. The emulsified asphalt shall conform to the requirements of ASTM D [977 and/or 2397] and may be of the SS, CSS, CQS, or QS type emulsions.

The cement mixing test is waived for these slurry type emulsions. The emulsified asphalt shall be either anionic or cationic, whichever is best suited to the aggregate and job conditions to be encountered. The type of emulsified asphalt to use will be determined by the mix design. The Engineer shall specify the type of emulsion and the controlling specification, which shall be from ASTM D977 or D2397, and the material shall be SS, CSS, CQS, or QS.

626-2.4 WATER. All water used in making the slurry shall be potable and free from harmful soluble salts and chemicals.

COMPOSITION AND APPLICATION

626-3.1 COMPOSITION. The slurry seal shall consist of a mixture of emulsified asphalt, mineral aggregate, and water.

626-3.2 JOB MIX FORMULA. No slurry seal for payment shall be placed until a mix design has been approved by the Engineer. The mix design shall be developed by a laboratory with experience in designing slurry seal mixes and a signed copy shall be submitted in writing by the Contractor to the Engineer at least 10 days prior to the start of operations.

The laboratory report (mix design) must indicate the proportions of aggregates, mineral filler (min. and max.), water (min. and max.) and asphalt emulsion based on the dry aggregate weight. It shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effects). The mix design shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new mix design shall be established before the new material is used.

The main items of design in emulsified asphalt slurry seals are aggregate gradation, emulsified asphalt content, and consistency of the mixture. The aggregates, emulsified asphalt, and water should form a creamy-textured slurry that, when spread, will flow ahead of the strike-off squeegee. This will allow the slurry to flow down into the cracks in the pavement and fill them before the strike-off passes over.

Technical Bulletin No. 111, Outline Guide Design Procedure for Slurry Seal, and publication A105 Recommended Performance Guidelines published by the International Slurry Surfacing Association (ISSA) contains information to aid designers of slurry mixes.

The contractor shall submit to the Engineer for approval a complete mix design on the materials proposed for use, prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate and grade of emulsified asphalt that the Contractor will provide on the project. At a minimum the required tests and values needed are as follows.

	DESCRIPTION	SPECIFICATION
ISSA TB-100	Wet Track Abrasion Loss One Hour Soak	50 g/ft ² Max (538 g/m ²)
ISSA TB-115	Determination of Slurry Seal Compatibility	Pass

626-3.3 APPLICATION RATE. The slurry seal shall be applied at the application rates shown in Table 1 for that gradation of material used.

626-3.4 TEST SECTIONS. Test sections shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designated by the Engineer and will be located on the existing pavement. Test strips shall be made by each machine after calibration. Samples of the slurry seal may be taken and the mix consistency verified by using ISSA TB-106 Slurry Seal Consistency test. Also the proportions of the individual materials may be verified by the Engineer by using the calibration information provided after machine calibration. If any test does not meet specification requirements, additional tests shall be made at the Contractor's expense, until an acceptable test strip is placed.

CONSTRUCTION METHODS

626-4.1 WEATHER LIMITATIONS. The slurry seal shall not be applied if either the pavement or air

temperature is below 50 °F (10 °C) and falling but may be applied when both pavement and air temperature are above 45 °F (7 °C) and rising. No slurry seal shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

The Engineer should not specify a lower permissible temperature range than that stated in 626-4.1, since slurry placed at lower temperatures usually will not cure properly due to poor dehydration and poor asphalt coalescence.

626-4.2 EQUIPMENT AND TOOLS. The contractor shall furnish all equipment, tools, and machinery necessary for the performance of this work.

a. Slurry Mixing Equipment. The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry seal mixing machine of either truck mounted or continuous run design. Either type machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, and water to a revolving mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for materials to maintain an adequate supply to the proportioning controls.

If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed of the machine during application of the slurry seal, with a self-loading device, with opposite side driver stations, all part of original equipment manufacturer design.

The aggregate shall be prewetted immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients together. No excessive mixing shall be permitted. The mixing machine shall be equipped with a fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed into the mixer.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.05 to 0.10 gallon per square yard (0.23 to 0.45 liter per square meter) preceding the spreading equipment.

Sufficient machine storage capacity to mix properly and apply a minimum of 5 tons (4 500 kg) of the slurry shall be provided. Proportioning devices shall be calibrated prior to placing the slurry seal.

b. Slurry Spreading Equipment. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the surface contact point. The rear seal shall act as the final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform mat.

c. Auxiliary Equipment. Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, barricades, etc., shall be provided as required.

d. Roller. The roller, if required, shall be a self-propelled pneumatic-tired roller capable of exerting a contact pressure during rolling of 50 pounds per square inch (350 000 Newton's per square meter). It shall be equipped with a water spray system, to be used if the slurry is picking up on the tires during rolling.

e. Tack Coat and Distributor. Normally a tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt and three parts water. The emulsified asphalt may be the same as that used in the mix. Pressure distributors used for application of the diluted asphalt emulsion tack coat shall be self-propelled, equipped with

pneumatic tires, and capable of uniformly applying 0.05 to 0.15 gallon per square yard (0.23 to 0.68 liter per square meter) of the diluted emulsion over the required width of application. Distributors shall be equipped with tachometers, pressure gages, and volume-measuring devices. The tack coat shall be applied at least 2 hours before the slurry seal but within the same day.

626-4.3 EQUIPMENT CALIBRATION. Each slurry mixing unit to be used on the project shall be calibrated in the presence of the Engineer prior to construction. Previous calibration documentation covering the exact materials to be used may be accepted by the Engineer provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

626-4.4 PREPARATION OF EXISTING SURFACE. Prior to placing the tack coat and slurry seal coat, unsatisfactory areas shall be repaired and the surface shall be cleaned of dust, dirt, or other loose foreign matter, grease, oil, excessive rubber accumulation, or any type of objectionable surface film. Any standard cleaning method will be acceptable except that water flushing will not be permitted in areas where considerable cracks are present in the pavement surface.

Any painted stripes or markers on the surface of the runways or taxiways to be treated, shall be removed.

Cracks wider than 1/4 inch (3 mm) shall be cleaned with compressed air, and sealed with a compatible crack sealer prior to applying the slurry seal. Crack wider than 3/4 inch (9 mm) should be pre filled and sealed with the slurry mixture prior to surfacing. Cracks that show evidence of vegetation shall be cleaned and treated with an approved herbicide.

626-4.5 APPLICATION OF SLURRY SEAL COAT. The surface shall be prewet by fogging ahead of the slurry spreader box. Water used in prewetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 2 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box which shall be towed at a slow and uniform rate not to exceed 5 miles per hour (8 kilometers per hour). No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry will be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box. The finished surface shall have no more than four (4) tear or drag marks greater than 1/2 inch (13mm) wide and 4 inches (100mm) long in any 12 foot by 22 foot (25 sq. meter) section. It shall have no tear or drag marks greater than 1 inch (25mm) wide and 3 inches (15mm) long.

The finished surface shall have no transverse ripples of 1/5 inch (5mm) or more in depth, as measured with a 10 foot (3 meter) straight edge laid upon the surface.

Adjacent lanes shall be lapped at the edges a minimum of 2 inches (50 mm) with a maximum of 4 inches (100 mm) to provide complete sealing at the overlap. Construct longitudinal and transverse joints shall be neat and uniform without buildup, uncovered areas, or unsightly appearance. All joints shall have no more than 1/4 inch (6 mm) difference in elevation when measured across with a 10 foot (3 meter) straight edge.

Generally, where normal traffic will iron out the slurry and close any hairline cracks of dehydration, it is not necessary to roll a normal thickness, 1/4 inch (6 mm) or less, slurry seal. However, in some instances the, somewhat lattice-like structure of the slurry should be densified by pneumatic-tire rolling to improve durability, such as areas subjected to severe braking or acceleration. Rolling of the slurry seal is at the option of the Engineer and, if required, must be designated in the plans.

If rolling is required by the Engineer, the surface shall be subjected to a minimum of two full coverage passes by the roller. These rolling passes are to be done as soon as the slurry mixture will support the roller without damage. When the surface of the existing pavement is irregular or broken, it shall be

repaired or brought to uniform grade and cross section by patching as directed in the project plans. With the exception of standard debris cleaning, all other repairs, crack sealing, and required removal of materials shall be a line item in the bid and noted in the plans.

The fresh slurry seal application shall be protected by barricades and markers and permitted to dry for 4 to 24 hours, depending on weather conditions. Any damage to uncured slurry will be repaired at the Contractor's expense.

In areas where the spreader box cannot be used, the slurry shall be applied by means of a hand squeegee. Upon completion of the work, the seal coat shall have no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform and skid resistant texture satisfactory to the Engineer. All wasted and unused material and all debris shall be removed from the site prior to final acceptance.

Upon completion of the project, the contractor shall sweep the finished surface with a conventional power rotary broom, to remove any potential loose material from the surface. The material removed by sweeping shall be disposed of in a manner satisfactory to the Engineer.

The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have a skid resistant texture. It is important to realize that slurry seal will not stop shrinkage and other large thermo cracks from reflecting back through the new slurry surface.

626-4.6 EMULSION MATERIAL (CONTRACTORS RESPONSIBILITY). Samples of the emulsion that the Contractor proposes to use, together with a statement as to its source, must be submitted, and approval must be obtained before using such material. The Contractor shall submit to the Engineer a manufacturer's certified report for each consignment of the emulsion. The manufacturer's certified report shall not be interpreted as a basis for final acceptance. All such reports shall be subject to verification by testing samples of the emulsion as received for use on the project.

METHOD OF MEASUREMENT

626-5.1 The emulsified asphalt shall be measured by the [gallon (liter)] [ton (kg)]. Only the actual quantity of undiluted emulsified asphalt will be measured for payment.

626-5.2 Aggregate shall be measured by the ton (kg) of dry aggregate.

626-5.3 Crack sealing shall be measured by the lineal foot (meter) of cracks sealed.

626-5.4 Surface repair shall be measured by the ton (kg) or square measurement of material placed.

626-5.5 Paint and rubber removal shall be measured by the lineal foot (meter) or square measurement.

BASIS OF PAYMENT

626-6.1 Payment shall be made at the contract unit price per [gallon (liter)] (ton (kg)) for the emulsified asphalt and at the contract price per ton (kg) for aggregate [and the contract unit price for crack sealing per lineal foot] [and the contract unit price for surface repair per ton (kg) or square measurement] [and the contract unit price for paint and rubber removal per lineal foot (meter) or square measurement].

These prices shall be full compensation for furnishing all materials, for preparing, mixing, and applying these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-626-6.1 Emulsified Asphalt for Tack Coat--per [gallon (liter)] [ton (kg)]

Item P-626-6.2 Emulsified Asphalt for Slurry Coat--per [gallon (liter)] [ton (kg)]

Item P-626-6.3 Aggregate--per ton (kg) of dry aggregate.

[Item P-626-6.4 Crack sealing -- per lineal [feet] (meter)

Item P-626-6.5 Surface Repair -- per [ton] (kg) or square measurement

Item P-626-6.6 Paint and Rubber removal -- per lineal foot (meter) or square measurement.
(meter)]

TESTING REQUIREMENTS

ASTM C 88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 128	Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	Resistance to Abrasion of Small Size Course Aggregate by Use of the Los Angeles Machine
ASTM C 136	Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D 75	Sampling Aggregates
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate
ISSA	International Slurry Surfacing Association, Washington, DC
ISSA A 105	Recommended Performance Guidelines
ISSA TB-100	Wet Track Abrasion Loss
ISSA TB-106	Slurry Seal Consistency
ISSA TB 111	Outline Guide Design Procedure for Slurry Seal
ISSA TB-115	Determination of Slurry Seal Compatibility

MATERIAL REQUIREMENTS

ASTM D 242	Mineral Filler for Bituminous Paving Mixtures
ASTM D 977	Emulsified Asphalt
ASTM D 2397	Cationic Emulsified Asphalt

ITEM D-701 PIPE FOR STORM DRAINS AND CULVERTS

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below.

701-2.2 PIPE.

Metallic Coated Corrugated Steel Pipe (Type I, IR or II)	ASTM A 760
Galvanized Steel Corrugated Structural Plates and Fasteners for Pipe, Pipe-Arches, and Arches	ASTM A 761
Polymer Precoated Corrugated Steel Pipe for Sewers and Drains	ASTM A 762
Post-Coated and Lined (Bituminous or Concrete) Corrugated Steel Sewer and Drainage Pipe	ASTM A 849
Fiber-Bonded Asphalt, Composite Coated, Corrugated Steel Pipe	ASTM A 885
Corrugated Aluminum Alloy Culvert Pipe	ASTM B 745
Vitrified Clay Pipe	ASTM C 700
Non-Reinforced Concrete Pipe	ASTM C 14
Reinforced Concrete Pipe	ASTM C 76
Reinforced Concrete D-Load Pipe	ASTM C 655
Reinforced Concrete Arch Pipe	ASTM C 506
Reinforced Concrete Elliptical Pipe	ASTM C 507
Precast Reinforced Concrete Box Sections	ASTM C 789 and C 850
Bituminous-Coated Corrugated Metal Pipe and Pipe Arches	AASHTO M 190
Bituminous-Coated Corrugated Aluminum Alloy Culvert Pipe	AASHTO M 190 and M 196
Bituminous-Coated Structural Plate Pipe, Pipe Arch, and Arches	AASHTO M 167 and M 243
Aluminum Alloy Structural Plate for Pipe, Pipe Arch, and Arches	AASHTO M 219
Polyvinyl Chloride (PVC) Pipe	ASTM D 3034
Corrugated Polyethylene Drainage Tubing	AASHTO M 252
Corrugated Polyethylene Pipe	AASHTO M 294
* Poly (Vinyl Chloride) Ribbed Drain Pipe & Fittings Based on Controlled Inside Diameter	AASHTO M 304
Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings	ASTM F 949

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701-2.3 CONCRETE. Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi (13.8 MPa) at 28 days and conform to the requirements of ASTM C 94.

701-2.4 RUBBER GASKETS. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C 443. Rubber gaskets for PVC pipe shall conform to the requirements of ASTM F 477. Rubber gaskets for zinc-coated steel pipe and precoated galvanized pipe shall conform to the requirements of ASTM D 1056, for the "RE" closed cell grades.

701-2.5 JOINT MORTAR. Pipe joint mortar shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.

ITEM D-702 SLOTTED DRAINS

DESCRIPTION

702-1.1 This item shall consist of the construction of slotted drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans. Pipe diameter and gage shall be as shown on the plans.

MATERIALS

702-2.1 PIPE. Metallic coated (galvanized or aluminized steel type 2) corrugated steel (type I) meeting the requirements of ASTM A760.

The corrugated steel pipe shall have a minimum of two rerolled annular ends.

702-2.2 GRATES. The grates shall be manufactured from ASTM A 36 or A 570, Grade 36 steel. Spacers and bearing bars (sides) shall be 3/16-inch (5 mm) material. The spacers shall be on 6 inch (150 mm) centers and welded on both sides to each bearing bar with four (4) 1-1/4-inch long 3/16-inch wide (32 mm long by 5 mm wide) fillet welds on each side of the bearing bar.

The grates shall be 6 inches (150 mm) high or as shown on the plans, and have a 1-3/4-inch (45 mm) opening in the top.

The grates shall be galvanized in accordance with ASTM A 123 except with a 2 ounce (0.057 kg) galvanized coating.

The grate shall be fillet welded to the corrugated steel pipe with a minimum weld 1 inch (25 mm) long on each side of the grate at every other corrugation.

Each 20-foot (6.1 m) length of drain delivered to the job site shall be within the following tolerances: vertical bow +/- 3/8 inch (9.5 mm), horizontal bow +/- 5/8 inch (16 mm), twist +/- 1/2 inch (12.5 mm).

702-2.3 CONCRETE. Concrete shall have a minimum compressive strength of 1,000 psi (6.9 Mpa) at 28-days when tested in accordance with ASTM C 39.

CONSTRUCTION METHODS

702-3.1 EXCAVATION. The width of the trench shall be sufficient to permit satisfactory installation and jointing of the slotted drain and placing of the high slump concrete backfill material under and around the drain, but shall not be less than the external pipe diameter plus 6 inches (150 mm) on each side. The depth of the trench shall be a minimum of 2 inches (51 mm) below the invert.

The trench may be roughly shaped to the slotted drain bed.

702-3.2 INSTALLATION. The slotted drain shall be laid in sections joined firmly together with coupling bands. The top of the grate shall be held firmly in place to the proper grade, to preclude movement during the backfilling operation.

702-3.3 JOINING. Joints shall be firmly joined by modified hugger type bands to secure the pipe and prevent infiltration of the backfill. When the slotted drain is banded together, the adjacent grates shall have a maximum 3 inch (76 mm) gap.

702-3.4 BACKFILLING. Slotted drains shall be inspected before any backfill is placed. Damaged drains shall be aligned or replaced at the contractor's expense.

The slotted drain shall be backfilled with a high slump concrete that will easily flow under and around the drain and the trench wall. The opening in the top of the grate shall be covered to prevent unwanted material from entering the drain during the backfilling and subsequent surfacing operations.

METHOD OF MEASUREMENT

702-4.1 The length of slotted drain shall be measured in linear feet (meters) of slotted drain in place, completed, and approved. It shall be measured along the centerline of the Slotted Drain from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types, and size shall be measured separately. All fittings shall be included in the footage as typical pipe sections being measured.

BASIS OF PAYMENT

702-5.1 Payment shall be made at the contract unit price per linear foot (meter) for each kind of slotted drain type and size designated and at the contract unit price per cubic yard (cubic meter) of concrete for backfill.

These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation and installation of these materials; and /or all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 702-5.1 [] inch (mm) diameter [] gage pipe per linear foot (meter)

The Engineer shall include a pay item for each size and gage pipe specified for the project

Item 702-5.2 Concrete for backfill-per cubic yard (cubic meter).

TESTING REQUIREMENTS

ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens

MATERIAL REQUIREMENTS

ASTM A 36 Structural Steel

ASTM A 123 Zinc (Ho-Dipped Galvanized) Coatings on Iron and Steel Products

ASTM A 570 Steel, Sheet and Strip, Carbon, Ho-Rolled, Structural Quality

ASTM A 760 Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains

ITEM D-705 PIPE UNDERDRAINS FOR AIRPORTS

DESCRIPTION

705-1.1 This item shall consist of the construction of pipe drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

705-2.1 GENERAL. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements.

Perforated Vitrified Clay Pipe	ASTM C 700
Perforated Concrete Pipe	ASTM C 444
Porous Concrete Pipe	ASTM C 654
Polymer Precoated Perforated Corrugated Steel Pipe	ASTM A 762
Perforated Corrugated Aluminum Alloy Pipe	AASHTO M 196
Perforated, Laminated Wall Bituminized Fiber Pipe	ASTM D 2418
Smooth-Wall Perforated PVC Pipe	ASTM F 758
Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings	ASTM F 949
Perforated Corrugated Steel Pipe	ASTM A 760
Bituminous-Coated Perforated Corrugated Aluminum Alloy Pipe	AASHTO M 196 and M 190
Corrugated Polyethylene Drainage Tubing	AASHTO M 252
Corrugated Polyethylene Pipe	AASHTO M 294
* Poly (Vinyl Chloride) Ribbed Drain Pipe & Fittings Based on Controlled Inside Diameter	AASHTO M 304 *

705-2.3 JOINT MORTAR. Pipe joint mortar shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.

705-2.4 ELASTOMERIC SEALS. Elastomeric seals shall conform to the requirements of ASTM F 477.

705-2.5 POROUS BACKFILL. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall conform to the gradation in Table 1 when tested in accordance with ASTM C 136.

TABLE 1. GRADATION OF POROUS BACKFILL

Sieve Designation (square openings)	Percentage by Weight Passing Sieves	
	Porous Material No. 1	Porous Material No. 2
1-1/2 inch		100
1 inch (225.0 mm)		90--100
3/8 inch (9.5 mm)	100	25--60
No. 4 (4.75 mm)	95--100	5--40
No. 8 (2.36 mm)		0--20
No. 16 (1.18 mm)	45--80	
No. 50 (0.30 mm)	10--30	
No. 100 (0.15 mm)	0--10	

When two courses of porous backfill are specified in the plans, the finer of the materials shall conform to particle size tabulated herein for porous material No. 1. The coarser granular material shall meet the gradation given in the tabulation for porous material No. 2.

ITEM D-751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

MATERIALS

751-2.1 BRICK. The brick shall conform to the requirements of ASTM C 32, Grade SM.

751-2.2 MORTAR. Mortar shall consist of one part portland cement and two parts sand. The portland cement shall conform to the requirements of ASTM C 150, Type I. The sand shall conform to the requirements of ASTM C 144.

751-2.3 CONCRETE. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item P-610.

751-2.4 PRECAST CONCRETE PIPE MANHOLE RINGS. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C 478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches (120 cm).

751-2.5 CORRUGATED METAL. Corrugated metal shall conform to the requirements of AASHTO M 36.

751-2.6 FRAMES, COVERS, AND GRATES. The castings shall conform to one of the following requirements:

- a. Gray iron castings shall meet the requirements of ASTM A 48, Class 30B and 35B.
- b. Malleable iron castings shall meet the requirements of ASTM A 47.
- c. Steel castings shall meet the requirements of ASTM A 27.
- d. Structural steel for grates and frames shall conform to the requirements of ASTM A 283, Grade D.
- e. Ductile iron castings shall conform to the requirements of ASTM A 536.

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

* All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123. *

751-2.7 STEPS. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of bituminous paint, when directed.

CONSTRUCTION METHODS

751-3.1 UNCLASSIFIED EXCAVATION.

a. The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the plans, or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall approximately only; and the